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THE HORN SPEAKER

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Romance of Radio
1914 to 1949

By W. FRANKLIN COOK
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1914 These were the "good old days"—when Radio was referred to as "wireless" most of the time—when only the stout-hearted dared walk into the room of a Radio fan and risk jarring the "cat's-whisker" off the long-sought-for sensitive spot on the galena crystal—when tubes were so microphonic that a heavy footstep anywhere in a house sounded like thunder in the phones—when practically all broadcasts were in code, and many a tense midnight listener mistook static for voices from the moon or Mars. "Bloopers," those unforgettable regenerative receivers developed by De Forest in 1912 and Armstrong in 1914, were just becoming known among experimenters; these sets acted like miniature transmitters during the tuning process, causing howls in neighboring receivers for blocks around. Loudspeakers existed only in the dreams of inventors; listening was done with headphones, and crushed and aching ears were the reward for perseverance.

The two-element rectifier tube had been invented by Fleming in 1906, and De Forest had added a grid to this tube in 1909. Pickard had perfected the crystal detector in 1907, and it was for many years the most popular of all detectors. Of course, Marconi had in 1901 amazed the world by broadcasting the letter "S" from Poldhu, England, to Saint Johns, Newfoundland. Our own NAA in Arlington, Virginia, went on the air in 1913 with a 100 kw. spark transmitter operating on 6,000 meters. About this same time Nauen, Germany, began broadcasting on 16,900 meters or about 18,000 cycles (just above the audio band), and station FL atop the Eiffel Tower in Paris began broadcasting on 10,000 meters. Many an old-timer still remembers tuning in these stations with a crystal set having huge tuning coils and an aerial hundreds of feet long. The Titanic had crashed into an iceberg in 1912, with Radio summoning assistance and bringing news of the disaster to a young wireless operator named David Sarnoff (now President of RCA) who was listening in a New York City skyscraper.

It was in 1914 that Hiram Percy Maxim founded the American Radio Relay League. War broke out in Europe this year, and amateur licenses were suspended in practically all foreign countries. American amateurs listened with suspicion to German Radio stations in this country and found at least one to be sending code reports on allied shipping to German submarines; recordings of the messages, turned over to the Secret Service, resulted in confiscation of this Telefunken station.

Broadcasting of entertainment—even of grand opera with Caruso singing—was now several years old, with the De Forest Radio Telephone Company starting things off with phonograph records in 1907. Only a handful of experimenters heard these first "canned" programs, and these were more interested in DX (distant) code reception than in the highly distorted and almost unrecognizable music. Few people even dreamed of the vast entertainment possibilities of Radio during these days, and James E. Smith founded the National Radio Institute in this year primarily to train men for careers as wireless operators on land and sea.

1915 Human voices leaped across the Atlantic for the first time in history; this radio-telephone conversation between radio operators at Arlington, Virginia, and the Eiffel Tower in Paris was also heard by listeners in Honolulu. More and more ships were being equipped with wireless, creating a demand for trained wireless operators. The ability of Radio to save lives at sea in time of disaster was demonstrated forcibly again and again.

1916 America was doing its best to keep out of the great conflict in Europe despite the sinking of the Lusitania by a German submarine in 1915. Wireless was adopted by the New York Police Department as a means of combatting crime. Across the seas, wireless telegraphy was made compulsory this year on all British vessels over 3,000 tons. Naval vessels of all countries were rapidly being equipped with wireless transmitters and receivers.

1917 America entered the World War. All amateur Radio enthusiasts pulled down their antennas and packed away their Radio apparatus in observance of a Government order. Many answered the Navy's call for volunteer wireless operators, and by the end of the war, over 3,500 American Radio Relay League members were in service as operators and Radio technicians. All activity in Radio during the war was concentrated in the various divisions of the Government and among Radio manufacturers who were making equipment for the Government.

1918 Radio played an important part in the activities of the U. S. Signal Corps in France, as well as in maneuvers of the U. S. Navy. Radio principles were applied to submarine-detecting apparatus for the first time. Radio technicians became an established unit of U. S. armed forces, doing all repair work on Radio apparatus. Tube manufacturers were making special hard (high-vacuum) tubes for the Navy, and somehow these tubes got out to the public shortly after the end of the war. Their superior performance doomed the former gaseous or "soft" tubes as amplifiers, although the soft detector was to reign supreme for some years to come.

1919 The war was over! All bans on Radio were removed and amateur Radio was re-established as a hobby. Spark transmitters were being junked in favor of vacuum tube oscillators, and more and more hams gave up C. W. for phone operation. Scores of commercial wireless stations were built in this country; most of them used the famous Alexanderson alternator, which was simply a huge A.C. generator capable of producing A.C. powers up to 300 kw. at frequencies over 100 kc. These alternators fed power directly to the transmitting antenna.

It was during this year also that Dr. Frank Conrad of Westinghouse broadcast phonograph records over a home-made transmitter in his garage in Pittsburgh, getting an avalanche of fan mail and requests for favorite recordings. Westinghouse officials were amazed at this interest in Radio.

From this small beginning in 1920 grew the 50,000 watt broadcasting station of KDKA.

1920 Westinghouse built its first transmitter in a little shack atop its nine-story factory in Pittsburgh. This station, eventually assigned the famous call letters KDKA, amazed the world with a broadcast of presidential election returns on November 2, 1920, followed by a report of Harding's election. Some two thousand newspapers began printing KDKA programs regularly; Radio was being acclaimed everywhere as the newest form of entertainment for the home, and receiver sales skyrocketed upward. Navy multi-range receivers left over from the World War were being sold to the public at this time, as also were receivers using honeycomb coils. "C" batteries made their appearance, pleasing the public because they cut down plate current and made "B" batteries last longer. Receiving tubes were hard to get, and cost anywhere from $6 up. Radio experimenters spent about $2,000,000 this year, not for complete sets but rather for parts with which to build their own crystal sets, small vacuum tube receivers, and transmitters. The first Armstrong superheterodyne circuit was announced, and amateurs immediately began experimenting with its circuit.

1921 Station WJZ at Newark went on the air and soon was broadcasting regular bedtime stories. The Dempsey-Carpentier prize fight broadcast made a hit; Radio had a sudden flurry of activity, with hardware, stationery,

drug and even millinery stores selling commercial receivers or merchandising the handiwork of a mechanically-minded son or kid brother. Horns with places for attaching headphones were offered at $10 and up; glass and wooden bowls were also widely used to boost the sound output of headphones and permit groups of persons to listen to programs. Attachments for holding phone units against the tone arms of phonographs were being sold this year.

Broadcasting stations were springing up like toadstools; while there were only 5 in December of the previous year, 532 more had gone on the air by September, 1922. More than 20,000 dealers rushed madly into this entrancing new field, and thousands more started manufacturing Radio apparatus. The majority of these received badly burned fingers toward the close of this year, when intense competition knocked the bottom out of prices. In New York, Chicago and elsewhere, cut-price Radio centers started up, offering the stocks of financially embarrassed and bankrupt Radio manufacturers at mere fractions of the original prices.

1922 WGY and WEAF went on the air, with WEAF making history by offering its facilities to advertisers. Major Armstrong announced his super-regenerative loop receiver, a 3-tube circuit which amplified signals over 100,000 times with "nary a bloop or squeal." Magnavox came out with a deluxe electrodynamic horn type loudspeaker. The Hartley regenerative receiver circuit was popular with experimenters. Practically every high school student of the time had a crystal receiver and spent hours jiggling the little coil of wire called a "cat's-whisker," in order to get maximum power into the headphones. What a thrill it was in those days to clamp on the headphones, tune the receiver and scratch up the crystal for half an hour, then have the thrill of hearing a station 25 miles away!

1923 Neutrodynes took the country by storm, and soon you were a social outcast if you didn't have one. These sets didn't squeal, and you could actually get a station twice in succession at the same dial setting—sometimes! President Harding had one of these receivers installed in the White House. Other popular receiver circuits included regeneratives and ultradynes; popular tubes were the 201A's, the 171A's and the UV199 "peanut" tubes. Vacuum tube receivers had replaced crystal sets, except possibly among the high school experimenters. Loudspeakers had come to stay. Set manufacturers prided themselves on the assortment of knobs and gadgets which decorated receiver panels, but already the public was calling for a single-knob control. Women resented the unsightly batteries, and inventors worked day and night to find some means of operating receivers from ordinary light socket power. Radio receivers became obsolete in from three to six months during these days, with even the larger companies selling surplus stocks at half-price and lower to clear the shelves for new models.

1924 President Coolidge's cat, presumably wandering in search of some errant love, was sought for and found by Radio, with newspapers making much of the story. Over 1,400 broadcasting stations were now pumping programs into the American ether; each station took any frequency it pleased in the band between 200 and 550 meters, since licenses did not specify any definite operating frequency. High-power transmitting tubes were not available, and the power radiated by each of these early stations was even less than that consumed by the average one-slice electric toaster. Daily broadcasts of Major League baseball games began this year, making a hit with fans.

The receivers being turned out by manufacturers were becoming more and more complex. By the thousands, an eager public snapped up superheterodynes, reflex sets, T.R.F. receivers and neutrodynes, and immediately there arose a need for skilled men to service these complex creations. Earlier receivers had been so simple that they seldom required servicing, and the real technical equipment in transmitters was being installed and maintained by trained factory experts, many of whom were NRI men. To meet the public demand for repairs on ailing receivers, Radio dealers began hiring men especially for servicing work—and thus a new profession was born. Early servicemen sweated over burned-out A.F. transformers in the famous De Forest Model D-7 self-contained loop receiver, which with four tubes and a crystal detector in a reflex arrangement gave seven stages of amplification. In the equally famous RCA "portable" superheterodyne, the catacomb coils and the extremely fragile type 199 tubes were going bad and creating profitable service calls. Western Electric came out this year with a magnetic horn loudspeaker, and this was soon supplanted in popularity by magnetic cone loudspeakers, some more than three feet in diameter.

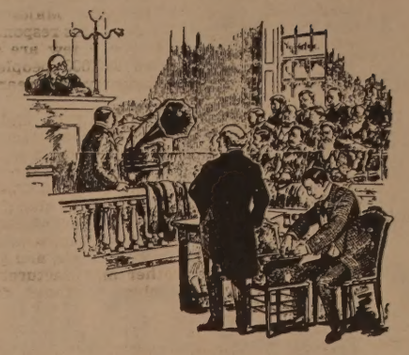
1925 Radio coils reached a peak in unique design; set builders had to choose from standard solenoid coils, pancake coils, spider-web coils wound on forms like the spokes of a wheel, honeycomb coils, toroidal or doughnut-shaped coils, binocular coils, bank-wound coils, random-wound coils and even figure-of-eight coils. Coil forms were often removed after the windings were cemented together with a coating of coil "dope," on the theory that this would reduce losses. The Raytheon cold-cathode gaseous type BH rectifier tube was perfected this year. Overproduction of receivers was a chronic complaint in the Radio industry, with hundreds of manufacturers plunging foolhardily into production schedules which inevitably resulted in bargain sales, receiverships and bankruptcies. Radio was now well established as a form of entertainment, and so intriguing was this entertainment to the public that each new improvement was received with open arms by all who could dig up the necessary money.

1926 The first all-electric sets timidly made their appearance, mostly with T.R.F. circuits and separate power packs. The "tinker" type of serviceman, seeing the array of chokes, filter condensers and voltage dividers in the power pack, silently dropped out of the picture. "B" eliminators became popular, with the type 80 tube sharing honors with the Raytheon BH tube as the rectifier in these units. The famous Browning-Drake receiver circuit revived a dying interest in set-building. The purchaser of a complete new Radio installation still had to choose five separate items in most cases: *1.* A Radio receiver in a table model cabinet; *2.* A loudspeaker; *3.* A set of tubes; *4.* An "A," "B," and "C" battery eliminator pack; *5.* A suitable table or cabinet for the various units.

A U. S. Court decided that the Secretary of Commerce had no power to regulate broadcasting—only the power to issue licenses. This decision made Radio broadcasting even more chaotic than before; new stations merrily started up and increased power in tremendous jumps in order to drown out rival broadcasts. Whistles and heterodyne squeals were heard on almost every program. This year also marked the start of the National Broadcasting Company, the first network of stations.

In England the British Broadcasting Company was granted a Royal Charter. Its license to broadcast contained only one important restriction, namely, that no money could be accepted from outside interests; in other words, there was to be no commercial sponsorship of Radio programs. Broadcasting in England was to be paid for by the manufacturers of Radio equipment, by the Government, and by means of license fees collected from owners of receivers.

1927 Television was the big topic of discussion this year. Television receivers were being sold in kit form and as complete sets by Jenkins, Baird, Freed-Eisemann and several others. These sets used elaborate scanning discs and neon crater lamps, with the same scanning discs and photoelectric cells at the transmitters. Mechanical television systems reached the peak of their popularity this year, and even telephone television was tested out (with this set up, two persons could see as well as talk to each other even though separated by many miles, but the quality of the image was very poor).



Before Long

(Phonograph gives evidence. Machine-made testimony admitted by Pittsburg Magistrate.—*Newspaper Headline.*)

COURT OFFICER (*in the near future*).—Do you solemnly swear that evidence which you give in this case will be the truth, the whole truth and nothing but the truth? So help you Edison.—*Puck.*

J. E. Smith assists the late Dr. C. Francis Jenkins, in early Television experiments. This photo was taken about 25 years ago.

A super-abundance of stations forced manufacturers to sacrifice tone quality and fidelity to sharp tuning in order that interfering stations could be tuned out. Sales of Radio receivers reached a new low; the public sat back, waiting, aware that perfected A.C. sets were just around the corner. The Federal Radio Commission was established by the Government to clear up the chaos among transmitters. The first act of this Commission was to revoke all broadcasting licenses; it then assigned channels and powers so that interference between stations was a minimum, and reduced the number of stations as well. The Columbia Broadcasting System was started. Single dial receivers became a reality, with the Kolster Six as one of the early leaders. The McCullough A.C. tube was announced.

1928 Attempts were made to bridge the Atlantic Ocean using mechanical television, but image quality was still poor and unsatisfactory either for commercial use or for entertainment. RCA put out the famous Radiola 17, an A.C.-operated receiver. Diode detectors began to receive consideration among set designers. Types 226 and 227 tubes with A.C. heaters were released by tube manufacturers and immediately snapped up by set manufacturers. The typical A.C. T.R.F. receiver of this day used type 226 tubes in the R.F. and A.F. voltage amplifier stages, a 227 tube as detector, a 71A tube in the output stage and an 80 in the power pack. A.C. screen grid tubes were announced the latter part of this year, with the 224 leading the list. Next came variable mu tubes and power pentodes.

1929 The Majestic receiver line, with several styles of console cabinets from which to

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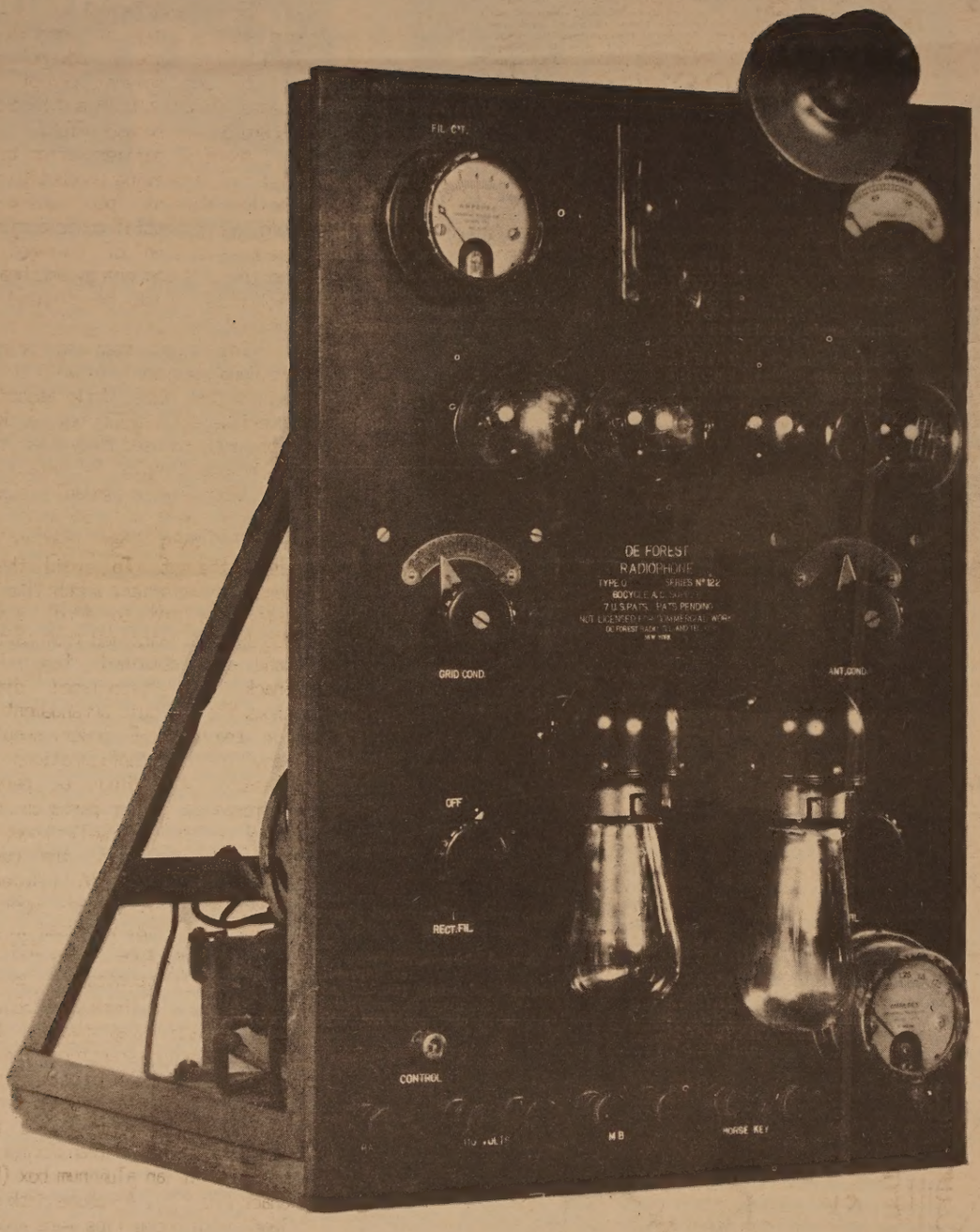

From the Frank Smith, W5VA, collection at the Corpus Christi City Museum. DeForest Radiophone, type O.

1947 During this year the number of radio receivers produced was again close to fifteen million, of which eight hundred thousand were f.m. receivers. Again the table model receiver was the best seller. Compactness was realized by using minature tubes and resistors, selenium rectifiers and miniature i.f. transformers. The printed circuit used in combination resistor-capacitor units was introduced. Again there was an increase in the number of broadcasting stations. The real value of the war-time research became evident in communications. There were improvements in aircraft radio. Airborne and shipborne radar in commercial navigation came into use and also new electronic circuits in industry. Electronic computers, radio frequency heating, photo-electric controls, and other electronic mechanisms were prominent improvements. The pulse techniques and other unique methods of modulating radio radiations began to appear. There was great progress in the frequency-modulated and television antennas along with the development of slot antennas for vhf and uhf. However, radar did not achieve the predicted position of importance which some optimists had predicted for it.

1948 Production of broadcast receivers continued heavily in the first part of 1948. People were insisting on well-known "name" products and gradually the supply caught up and passed the demand. The chief reason for this was that Television was coming into its own. The RMA standard for television transmissions had previously been accepted, and in 1948 it became clear that its framework resulted in good techniques of transmission and reception. In the larger areas of New York, Washington, Baltimore, Boston, Chicago, etc., Television was the main topic of discussion. The telecasting of Republican and Democratic conventions from Philadelphia made newspaper headlines throughout the nation. People bought television receivers as they became available. The RCA 630 and the Dumont were the basic receiver circuits and were licensed to the other manufacturers. The radio industry took on the production of TV receivers in earnest. During 1948 a 7-inch tube receiver made its appearance in the low-price market. The most popular, however, was the 10-inch receiver. A 12-inch set remained high priced and a 15-inch set was definitely a luxury.

A number of projection receivers also appeared on the market. Television was here. Its acceptance was no longer doubted. The communications field increased in activity and vhf, uhf and micro-wave came into their own for civilian use. Mobile communications services expanded, including taxicabs, railroads and other common carriers. In the phonograph field, the so-called LP phonograph record was introduced, making it possible to accommodate the average symphony or concerto on a single disc, with attendant saving in storage space.

1949 No one any longer questions that Television is here. Everyone looks forward to the rapid growth of TV reception. In fact, progress was so rapid that the FCC had to freeze new grants in order to re-examine the method of allocation. With the assurance that the present 12 channels will not be disturbed but merely supplemented in the future, industry scheduled the production of two million TV receivers in 1949. Reports show that this production figure should be reached or even surpassed.

The RCA 16-inch metal tube has made its appearance. Other makes are featuring the 15-inch glass and the 16-inch metal picture tube. The public wants larger screens. Apparently the 7-inch will be the portable, the 10-inch the low-priced, the 12-inch the normal, and the 15- and 16-inch the better TV receivers. Prices are dropping at this writing and a 10-inch television receiver can be purchased for well under two hundred dollars, whereas the same receiver in 1947 and 1948 sold for over three hundred. The industry is even talking about color television, although the methods are not certain.

RCA got out its own micro-groove record, introducing the 45 rpm 7-inch record with a unique fast-acting reproducer. The industry is faced with the problem of building phonographs that will take the old 78 rpm, the new LP 33 1/3 rpm and new RCA 45 rpm records. The solution seems to lie in the three-speed record changers now appearing on most new console receivers.

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TV Transformers and Yokes

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RADIO & TELEVISION NEWS

Review of the use of power and flyback transformers and deflection yokes, together with service hints.

THE three most costly components of the average TV receiver, aside from the picture tube, are the power and flyback transformers and the deflection yoke. In making repairs or selecting a suitable replacement for any of these parts, it is helpful to know more about the component and to get some idea as to how it works.

To the service technician, the designer, and the manufacturer, a comprehensive set of specifications is required to describe a transformer accurately. Some of the more important specifications of each of the three major items and their relation to service work are discussed in this article.

Many of the basic criteria discussed for the power and flyback transformers are also applicable to the vertical sweep output transformer.

Power Transformers

The various types of transformers in this category include autotransformers which have a primary connected to the a.c. power line. Basically, the specifications for any power transformer are dictated by the power requirements of the TV receiver. Since the receiver circuitry requires certain d.c. voltages and currents, with a minimum of a.c. ripple, the rectifier and filter portions of the power supply must be designed to meet this need. The power transformer, in turn, must be designed for use with a certain rectifier and filter circuit to get satisfactory performance. For example, the transformer needed if the filter input contains a 10 μfd. capacitor is different from the one that would be used with an input capacitor of 80 μfd. Whether the circuit uses a selenium or 5U4 tube rectifier also influences the choice of tranformer.

The following technical specifications are generally used to describe a power transformer:

Primary—for TV use 117 volt, 60 cps, is standard. Primary current is not usually stated.

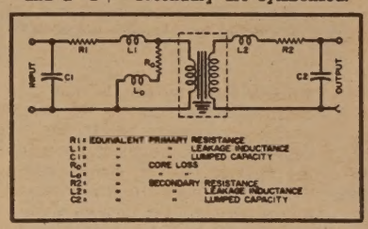
Heater windings—one or more 6.3 volts, with current ranging from 6 to 10 amperes per winding. Many transformers have additional 6.3-volt windings for the picture tube, damper tube, or other uses. These special windings are usually rated at 1.2 amperes.

Rectifier filaments—most transformers have a 5-volt winding with 2 or 3 amperes of filament current for each rectifier tube used. In general, 5U4 dual diodes are used, but in many recent receivers 6.3-volt types have made their appearance.

"B+" power—this is usually stated in two ways. The a.c. secondary voltage from the rectifier plate to the transformer center-tap is given in r.m.s. volts, and the d.c. current passing through the rectifiers is shown in milliamperes. Many transformer manufacturers also give the rectifier nomenclature and the d.c. voltage and current values available with a stated capacitor value at the rectifier cathode. The reason for this information lies in the fact that large capacitors result in considerable surge currents, while the plate resistance of the rectifier is a limiting factor of available d.c. voltage.

It should always be kept in mind that the current and voltage stated in the transformer specifications depend on fulfilling all other specifications. For example, if one of the heater windings is short circuited, all of the other voltages will drop. Similarly, if the primary voltage is low, all of the others will also be lower than specified. Low filament voltage at the rectifier results in less "B+" current and lower "B+" voltages throughout the receiver.

Fig. 1. Equivalent circuit for the typical power transformer. The primary winding and a "B+" secondary are symbolized.



To illustrate the actual operation of a transformer, Fig. 1 shows the equivalent electrical circuit of the primary and a single "B+" type secondary. Note that there is a grounded shield between the two windings. This electrostatic shield consists of some aluminum or copper foil wound over the primary winding. Its purpose is to reduce electrostatic coupling of high frequency noise which would interfere with the TV picture and sound.

The electrostatic shield should not be confused with the broad copper band seen on the transformer of Fig. 2. This serves as a magnetic shield. There is some confusion about the ability of copper to act as a magnetic shield, but the actual operation of this feature is quite simple. The wide copper band forms a shorted turn in the transformer field, with considerable current circulating in the copper. This current sets up a magnetic field in opposition to the main transformer external field. If the copper loop were removed or unsoldered, the external field might be sufficient to cause interference in the picture tube operation.

Repairing power transformers is usually limited to fixing the leads projecting from the shell or located directly on the exterior of the outer winding. When an open circuit is indicated, check the leads as close to the transformer body as possible. It is generally not recommended that the entire unit be taken apart and the wiring unwound to find a broken lead. If the damage occurs near the edge of a winding, visible from the outside, the wire can sometimes be repaired with a very small soldering iron. In most instances, a defective power transformer will call for a replacement—and an exact replacement at that. Mounting methods, size, and the electrical specifications must all be considered in selecting a replacement. Fortunately, most transformer manufacturers publish lists of replacement components for exact receiver types and models.

Flyback Transformers

Those who have been in the TV servicing field since the days of the early 630 models will recall the evolution of flyback transformers from the powdered iron types to the present-day ceramic core, high-efficiency, high-voltage units. Hand in hand with this evolution, the number of types of flyback transformers has also increased. Today there are almost as many different flyback transformer types as there are TV set models and whenever possible, the correct replacement type has to be obtained.

Flyback transformers vary considerably in appearance as well as electrically. Some types include mounting space for high-voltage rectifier tubes and capacitors (Fig. 3), others have windings for several rectifier filaments, some have the core grounded, and on others the core is well insulated from ground.

Electronically, the flyback transformer is far more complex than the power transformer even though its equivalent circuit is the same. Because of the higher frequencies it must handle, the distributed capacity, leakage, and core losses become very important. The "Q" of the transformer is usually quite critical since it determines the efficiency of the horizontal sweep and the high-voltage section. Cores of flyback transformers are care-

fully matched for optimum "*Q*" and such details as the air gap, wire insulation, and high-voltage breakdown of the mounting board are all critical factors in flyback production. Even the lead length from the high-voltage terminal to the rectifier tube plate cap often controls the "*Q*" and therefore the anode voltage. In some circuits it was found that by shortening this wire by two inches the anode voltage could be raised by 1000 volts.

Most recent flyback transformers are generally of four basic types, irrespective of physical appearance. The first type, easily recognized, is the autotransformer having an air core. It is used together with a high impedance deflection yoke in some earlier receivers and is illustrated in Fig. 4. A second, very popular type, is the autotransformer having a ferrite core. The remaining two types have ferrite cores and differ in that the core may be at ground potential or the core may be floating in order to reduce the over-all capacity to ground. See Figs. 5 and 6.

Some of the most frequent troubles due to either a defective flyback transformer or an incorrect replacement are described below.

Arcing or corona. Due to temperature variations inside a TV set, the insulation of the high-voltage coil of the transformer may crack. Or, the internal insulation of the coil may have been damaged allowing moisture to condense between windings. These defects lead to arcing.

Internal transformer arcing can sometimes be cured by heating the transformer under a heat lamp and then impregnating it with high-temperature wax. Most frequently, replacement will be indicated since old age affects transformer "*Q*" as well as insulation. When arcing or corona appears to originate in the high-voltage section, lead dress should be carefully inspected. Pay particular attention to the high-voltage rectifier lead, making certain that it is well in the clear and as short as practicable.

Insufficient width. This may not be due to the flyback transformer but to the horizontal drive circuit or any of the tubes prior to the transformer. Often, a new transformer provides a higher anode voltage, making poor width more apparent. The usual remedy is to connect a .001 to .01 μfd. capacitor across a portion of the transformer secondary to reduce the anode voltage and thereby give more width. Checking the cathode current control-grid bias, and screen-grid voltage of the horizontal output tube may locate a source of insufficient width.

Insufficient high voltage. This may occur when the transformer is dried out and has high leakage currents and a poor "*Q*" or a replacement does not match perfectly. In any instance where it is desired to step up the anode voltage by approximately 1000 volts this can be done by returning the ground side of the high-voltage filter capacitor to the "hot" side of the deflection yoke. Reducing the value of the screen-grid resistor of the output amplifier also helps, but the cathode current of that tube must be kept within the recommended limit (75 to 100 milliamperes).

Foldover and nonlinearity. This sometimes appears even when a new transformer is installed, and is due to mismatch with the horizontal output amplifier circuit or the deflection yoke. To correct this condition, first adjust the horizontal drive control, linearity coil, and width coil. A new output tube and/or damper tube may also be needed. If nothing else avails, a new deflection yoke may be required.

Such a mismatch can occur because of uneven aging among these components.

Singing. This type of defect is quite annoying, and is usually apparent only after a replacement unit has been installed. Usually, this is due to a mechanical vibration at the horizontal sweep frequency, and the obvious remedy would be to dampen it. Placing a strip of felt, sponge rubber, or "Vinylite" between the transformer mounting and the chassis should cure the vibration. If the transformer itself seems to "sing," a spraying with acrylic or similar insulating material between the coils, core, and brackets of the transformer is suggested.

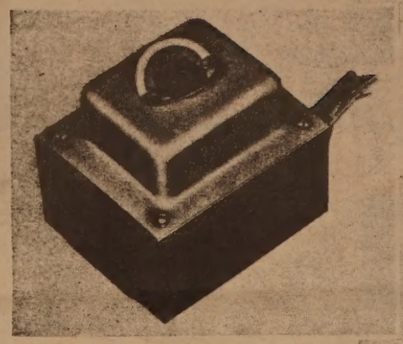


Fig. 2. Typical TV power transformer. Notice the socket for the rectifier tube.

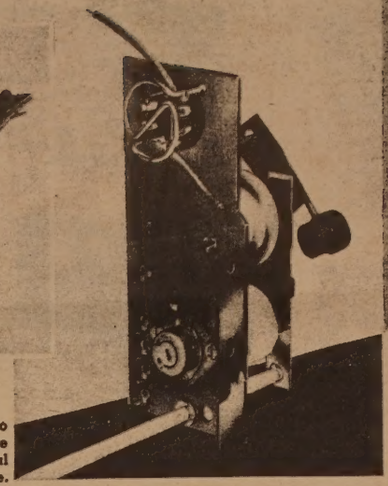


Fig. 3. Flyback transformer which also contains a socket for the high-voltage rectifier as well as the horizontal centering potentiometer on its base.

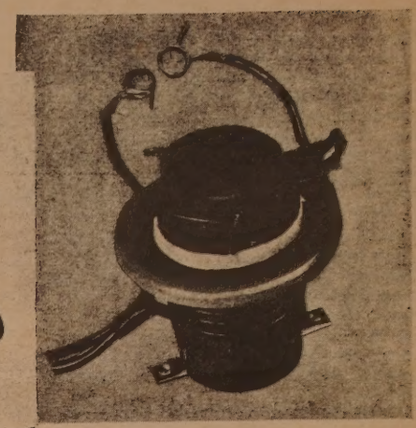


Fig. 4. Flyback transformer with an air core, as used in earlier TV sets.

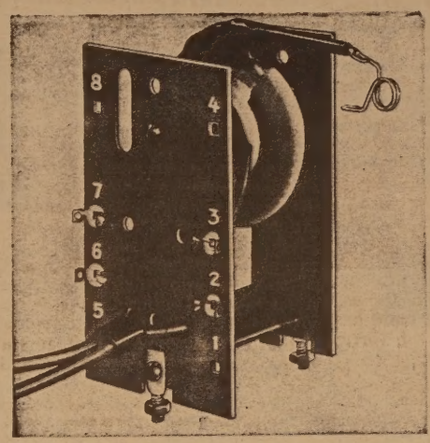


Fig. 5. This flyback transformer has a floating core, i.e., it is ungrounded.

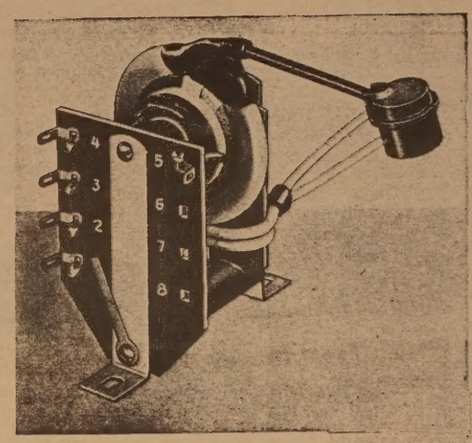


Fig. 6. The flyback transformer shown here has a grounded ferrite core and was used in many Admiral receivers.

Deflection Yokes

Fortunately the service technician does not have to replace deflection yokes too often, nor is there much to be repaired in this component. The deflection yoke, however, can be the cause for quite a bit of serious trouble ranging from burn-out of the flyback transformer to a slight nonlinearity, edge scalloping, or pin-cushioning.

Basically the deflection yoke consists of four separate coils, arranged in two pairs as shown in the diagram of Fig. 7. The horizontal deflection coils are inside, closest to the neck of the picture tube and are located above and below the electron beam. The vertical coils are located to the right and left of the CRT neck. The resistor and capacitor values shown in Fig. 7 are typical ones.

Three major criteria govern the design and operation of deflection yokes. These are impedance of the windings, deflection angle, and the type of winding and core material.

Deflection angles for older picture tubes range from 52° to 66° while most of the large screen picture tubes have either a 70° or 90° deflection angle.

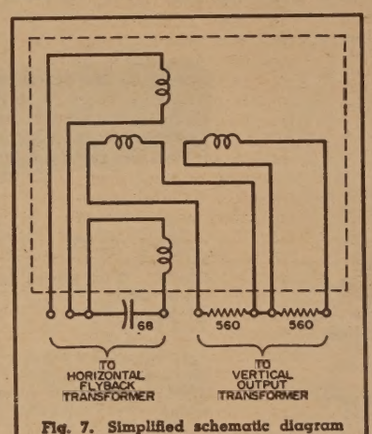


Fig. 7. Simplified schematic diagram of the vertical and horizontal coils of a typical deflection yoke. The resistor and capacitor values shown are merely typical ones and vary with yokes.

Impedances for the horizontal coils range from 8.3 to 30 millihenrys while the vertical coils vary from 3.3 to 50 millihenrys, with the latter figure and 43 millihenrys in widest use. The d.c. resistance ranges from about 4 to 60 ohms for either set of coils.

The core material of earlier yokes was powdered iron. Then, iron wire was used, and now most models have ferrite cores and are constructed like the one shown in Fig. 8. Note that insulation is provided between the coils and the grounded core segment. During aging, heating, etc., this insulation might become brittle and break down. This can cause arcing and internal shorts.

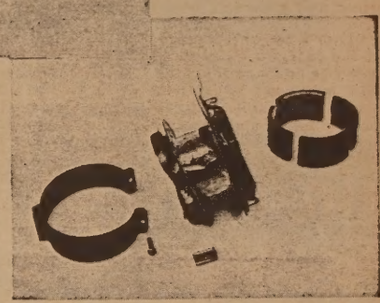


Fig. 8. Disassembled deflection yoke of the wide-angle variety for large CRT's.

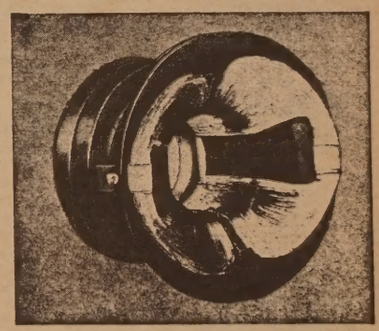


Fig. 9. The assembled deflection yoke.

In the assembled deflection yoke of Fig. 9, the flare of the horizontal coils, the orientation of all four coils, and the windings are quite critical. This illustration of a 90° yoke shows the precision and care required to avoid crosstalk, pin-cushioning, distortion, and poor over-all focus. The latter was encountered when some of the earlier yokes were used with large-screen, wide-angle picture tubes. To overcome this poor focus, the horizontal coils are wound according to a modified cosine

function so that as the electron beam is deflected farther from the center the focal point also changes. This uniform focus feature was sometimes obtained at the expense of pin-cushioning at the sides of the picture, but most present-day deflection yokes provide good linearity as well as over-all focus.

When the damping capacitor or resistors mounted inside the deflection yoke housing go bad, ringing (vertical bars at the left of screen), excessive and distorted height of half the picture, compression of half the picture, or Barkhausen oscillations usually result. The latter may also be due to sloppy wiring or a defective output tube.

Defects due to the deflection yoke itself can best be repaired by replacing the yoke with a new unit. These troubles include pin-cushioning, nonlinearity, lack of vertical or horizontal sweep, arcing inside the deflection yoke, insufficient width, poor high voltage, burned-out flyback transformer, and excessively dim, expanded picture. The defects causing these troubles can be either an open or short or partial short circuit in any of the windings, lowered "Q," or insulation breakdown. Replacing the yoke with a good one is usually simpler and cheaper than attempts at repair. —30—

RADIO AND TELEVISION NEWS
FEBRUARY 1956

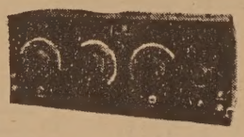
1925 BATTERY RADIOS CONTINUED FROM LAST MONTH

TRADE NAME: "Erla Table Cabinet."
MODEL: Cabinet.
TYPE: SuperFlex.
TUBES: Three, four or five.
BATTERIES: Storage batteries for three and four-tube sets, dry cells for five-tube set.
CONTROLS: Two.
AERIAL: Outside with three and four-tube sets, loop with five-tube set.
PRICE: Three-tube, $85.00; four-tube, $95.00; five-tube, $105.00 without accessories.
MANUFACTURER'S NAME: Electrical Research Labs.

TRADE NAME: Etherphone.
MODEL: RX-4.
TYPE: Reflex.
TUBES: Two.
BATTERIES: None furnished, but compartments provided for in set.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.

TRADE NAME: Etherphone.
MODEL: RX-3.
TYPE: Reflex circuit.
TUBES: Two.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $45.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.

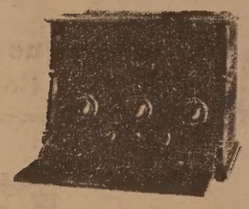
TRADE NAME: Etherphone.
MODEL: TR-5.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.



TRADE NAME: "Fada."
MODEL: 160.
TYPE: Two stages tuned radio, detector and two audio.
TUBES: Four.
BATTERIES: "A," 6-volt storage; "B," 60 to 90 volts.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $120.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Neutro-Junior.
TYPE: One-stage radio, detector and two audio.
TUBES: Three.
BATTERIES: None furnisned. "A" and "B" needed.
AERIAL: Outside.
CONTROLS: Two.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Neutro-Lagrand.
TYPE: Two tuned neutralized radio, detector and two audio, built-in loud speaker.
TUBES: Five.
BATTERIES: Furnished.
CONTROLS: Three.
AERIAL: Outside and inside.
PRICE: $270.00 complete with built-in loud speaker.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.



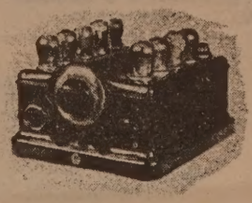
TRADE NAME: "Fada."
MODEL: Neutrola; built-in loud speaker.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90 "B." Not furnished.
CONTROLS: Three.
AERIAL: Outside.
PRICE: $220.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Neutro Receiver Grand.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $210.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Neutroreceiver.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $160.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Victor Console.
TYPE: Neutrodyne; two tuned radio, detector and two audio for installation in Victor Console Model Phonograph No. V.V. 215.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Farrand Godley."
MODEL: Single 9.
TYPE: Five-stage neutralized tuned radio frequency, detector and three audio.
TUBES: Nine.
BATTERIES: "A," 6 volts; "B," 90 and 22½.
CONTROLS: One.
AERIAL: Loop inside or outside.
PRICE: $195.00 without accessories.
MANUFACTURER'S NAME: Farrand Mfg. Company.



TRADE NAME: "Farrand Godley."
MODEL: Single 9 in cabinet.
TYPE: Five-stage neutralized tuned radio frequency, detector and three audio.
TUBES: Nine.
BATTERIES: "A," 6 volts; "B," 90 and 22½.
CONTROLS: One.
AERIAL: Loop inside or outside.
PRICE: $235.00 without accessories.
MANUFACTURER'S NAME: Farrand Mfg. Company.

(TO BE CONTINUED NEXT MONTH)

Antique Radio Collector
and related items

Glen S. Lee
R.R. #2
Mt. Brydges, Ontario
Canada N0L 1W0
519-264-9115

SOCIAL EVENTS

++++++++++++++++++++++++++++++++

VINTAGE RADIO and PHONOGRAPH SOCIETY CONVENTION — October 17-18- 19, 1986. Dallas, Texas. Write, Mike Sherman, Heritage Company, 311 Market Street, Dallas, Texas 75202 or call toll free (800) 527-9250.

++++++++++++++++++++++++++++++++

NORTHLAND ANTIQUE RADIO CLUB

A new organization has been formed to aid in the hobby of collecting old radios in Minnesota and the upper midwest. A group of collectors from the Minneapolis — St. Paul area has organized The Northland Antique Radio Club, which is involved in all aspects of the hobby.

TV COLLECTION FOR SALE

RCA model CT-100, 15" color TV, 1954, mahogany floor model, 37 tube, completely restored cabinet and electronics, $2,900,obo.

Farnsworth model 651-P, 10" B/W, 1948, walnut table model, 29 tube, completely restored cabinet and electronics, $995,obo.

Scott Radio Labs. model 6-T-11, 1948, projection B/W TV, mahogany table model, 34-tube, completely restored and electronics, $850,obo.

RCA model 721TS, 10" B/W TV, 1947, walnut table model, 21-tube. unrestored, cabinet in good condition, $225.00

Panasonic model TR-001, 1 1/2 B/W TV, 1971, handheld, good condition, $200.00.

Sinclair model MYV1, 1" B/W TV, handheld, good condition, $150.00.

Philco model Predicta, 17" B/W TV, floor model, unrestored, cabinet in good condition, $200.00.

Motorola model Teleplayer 3TS-471 chassis, EVR video playback, new, $200.00.

Edison Diamond Disc, Official laboratory model, phonograph, 1918, mahogany floor model, good condition, $400.00 with over 100 discs.

Atwater Kent model 10B, breadboard radio, good condition with both labels, $350.00.

——— Shipping not included in price.

Bill Russell
3236 Laurel Canyon
Santa Barbara, CA 93105
(805) 682-8115

Bi-monthly meetings are being scheduled, featuring guest speakers, demonstrations, buy/ sell/ swap sessions, displays and a variety of outings. Dues are $10.00 per year, which covers activity expenses as well as the cost of a newsletter with free ads.

The initial meeting of the club was scheduled for June 21 for the purpose of planning future events andto promote charter membership involvement. Interested collectors may write for additional information and membership application. The address is: Northland Radio club, P. O. Box 18362, Minneapolis, MN 55418.

LETTERS

Hi,

..... I am looking for an original owners manual for an E. H. Scott Imperial. If you should find one, please let me know. (#5986)

Thanks,
Ray Schober
6938 Western Ave.
Omaha, NE 68132

Dear Sir:

Has anyone ever had or fixed a Colonial model 33AC radio remote control.

Russ Schoen
R# 1, Box 224
Clintonville, WI
54929

Dear Sir,

I got your name from Dr. Turke of Medco Corporation. Please send me a sample copy of your newsletter on antique radios as soon as possible. Also, I recently started collecting early receivers. Would you know where I may obtain a "Rocket Radio" popular in the 1960s. Looks like a 4" rocket, crystal set action using a loop stick antenna.

Jim Snow
c/o 6 Anglin Cres.
Apt. #7
Saint John N.B.
Canada E2K 3R3

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ACME 'ACMEFLEX' (1925, VG TO EXC, UNTRIED, BOTH AUDIOS OK) $75 —— PHILCO 43B (1932, EXP REF'D, WORKS) $190 —— PHILCO 70B (1931, NICELY REFINISHED, SMALL VENEER PATCH ON THE TOP REAR OF CABINET, WORKS) $190 —— BULB SHAPED TUBES AND RADIO BOOKS ——— SEND LARGE 2 STAMP S.A.S.E. FOR COMPLETE AND UP-TO- DATE PHOTO LIST. ——— RON BOUCHER, 376 CILLEY ROAD, MANCHESTER, NH 03103. (603) 669-1698.

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WANTED

SPARK EQUIPMENT -Parts, especially including Commercial Rotary Gap, RF Spark Condenser, or even completer rigs. Paul C. Crum, W9LC, 6272 N. Cicero Avenue, Chicago, Illinois 60646. (312) 282-3033.

WANTED HALLICRAFTER SX-71 OR NATIONAL NC-183 in excellent condition. Please state price and condition when corressponding. Roy Schmitt, Rt. 1, Box 800 Lot 84, Converse TX 78109 (512) 659-0094.

McINTOSH INFORMATION- books, brochures, owner manuals, etc. or sources of information. Also want McIntosh equipment. John Kendall, 600 Remington Road, Fallston, MD 21047.

WANTED COAXIAL OR TRIAXIAL SPEAKERS of Jensen, Trusonic, Tannoy, Altec 604's. Western Electric equipment (tubes, amps., drivers, horns, speakers, microphones and parts). Radio tubes (50's, 211, 845, 8005) David Yo, P. O. Box 832, Monterey Park, CA 91754. Tel. (818) 576-2642.

CATHEDRAL RADIOS, MUST BE NICE AND WORKING CONDITION. WILL PAY TOP DOLLAR. ALSO WANT OTHER UNUSUAL AC RADIOS. HAROLD PERKINS, 4468 SUN VALLEY DRIVE, LAS VEGAS, NV 89121.

WANTED —— RCA CREDENZA'S, Edison windups - speaker systems and components, JBL Hartfield, Paragons- Altec Laguna, Magnificent, 515A/B, 288B/C, 604B/C/D/E, E.V. Patricians, Tannoy Autograph, GRF - Red/ Silver/ Gold, Jensen G610, Western Electric theatre equipment, speakers, drivers, horns, electron tubes, mixers, x-formers, x-overs, tubes, round top 45, 50 - W.E. 252A, 300A/B, 350B, etc. Charles Dripps, 4331 Maxson Road, El Monte, CA 91732. (818) 444-7079.

WANTED —— GRANDFATHER CLOCK RADIO and Radiola IV. Gordon Wilson, 11108 - 50 Avenue, Edmonton, Alberta, CAnada, T6H 0H9

WANTED— OLD 1960s or 70s large Allied Radio Catalogs. Earl Phillips, 311 David Lane, Maryville, TN 37801.

WANTED: BOOKS; buy, beg, borrow, rent or steal. Twining, "Wireless Telegraphy and High Frequency Electricity;" Curtis, "Construction of Induction Coils & Transformers;" Collins, "The Amateur Electrician's Handbook;" and other books with Tesla coil projects. Need data for forthcoming bibliography. TCBA, RD 3, Box 181, Glens Falls, NY (518) 792-1003.

WANTED- INSTRUCTIONS FOR OPERATING Hickock tube tester model # 600-A plus supplement tube data sheets. Zerox cópies OK. Frank Hoffert, 19605 Chardon road, Cleveland, OH 44117. Tel. (216) 481-0226.

WANTED— OLD 1960s or 70s large Allied Radio Catalogs. Earl Phillips, 311 David Lane, Maryville, TN 37801.

WANTED— FOUR WIRE OSC. COIL 266KC or Philco part 322828. Don Aldred, 39 East 8th Street, Jacksonville, FL 32206.

URGENT— URGENT—— NEED PART FOR VOLUME CONTROL FOR AK BREADBOARD MODEL 10. STRIP THAT HAS WIRE WOUND ON INSIDE OF CONTROL. RUSS SCHOEN, R#1, CLINTONVILLE, WI 54929.

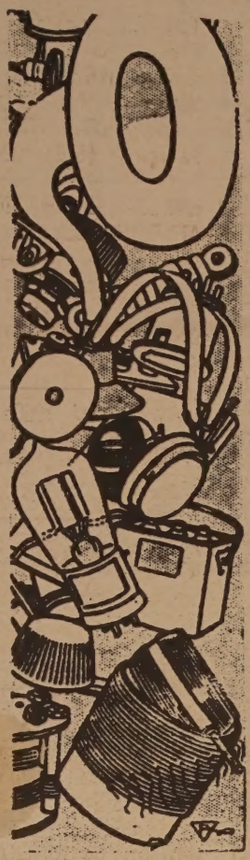
WANTED: INFORMATION OR EQUIVALENT CHARTS ON MUTER BRAND BALLAST TUBES. OLD CATALOGS MAY LIST THEM. ANTHONY JACOBI, 8053 MAYWOOD, RALSTON, NE 68127.

WANTED - New or used 0A2 voltage regulator tubes. Need 1200, must be reasonable. Tom Burgess, Box 9769, Little Rock, AR 72219 - (501) 565-1750 evenings.

WANTED: GRANDFATHER CLOCK RADIO, AK, Philco, etc. Gordon Wilson, 11108 - 50 Avenue, Edmonton, Alberta Canada T6H 0H9.

WANTED: ONE REMLER DRUM DIAL WITH DIAL PLATE. THIS DIAL IS GEAR DRIVEN AND IS ABOUT 4" IN DIAMETER. MUST HAVE A CLEAN DIAL SCALE. WILL PAY $25 FOR A CLEAN COMPLETE UNIT. BOB HERBIG, 4178 CHASIN STREET, OCEANSIDE, CA 92056.

FOR SALE: SCOTT PHILHARMONIC housed in Scott Rivinia Grand Console, includes original Presto Record Cutter, original Garard phonograph phonograph, with special chrom PRE-AMP, original Scott remote control with control box, and original keys to lock all four doors. Set is complete. Trade or best offer. Denis Yanko, 410 N. Summit, Oconomowoc, WI 53066. (414) 965-3641 after 5:00 cst.



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Philco: 48-700..$225 48-1000..$150 48-1001..$100
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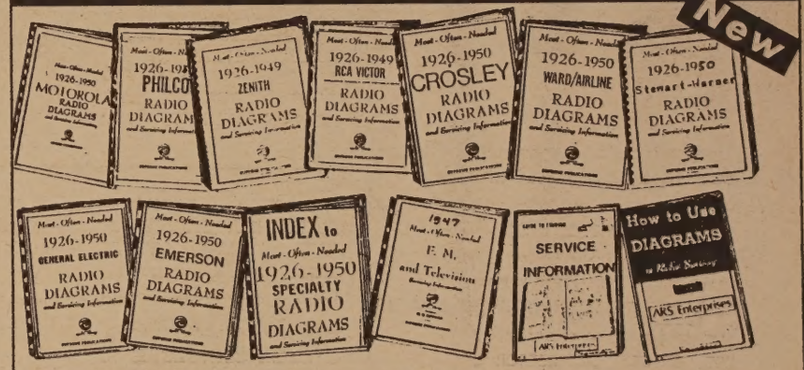
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1926-1950 CROSLEY RADIO DIAGRAMS
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1926-1950 Stewart-Warner RADIO DIAGRAMS
1926-1950 GENERAL ELECTRIC RADIO DIAGRAMS
1926-1950 EMERSON RADIO DIAGRAMS
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☐-Zenith	SM-6	17
☐-Motorola/Galvin	SM-7	14
☐-Emerson	SM-8	10
☐-Stewart-Warner	SM-9	8
☐-Index	SI-1	4
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☐-How To Use Diagrams	P-4	2

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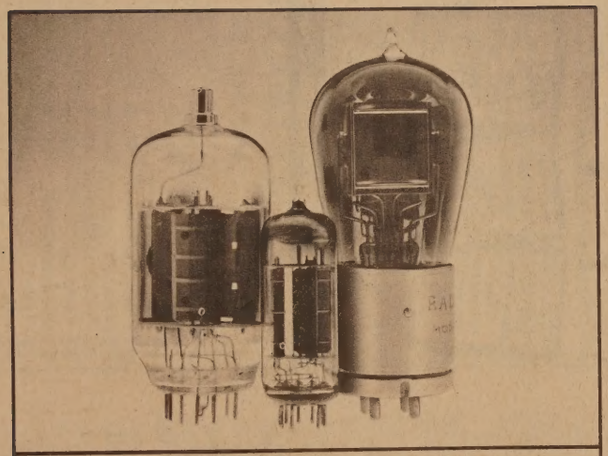

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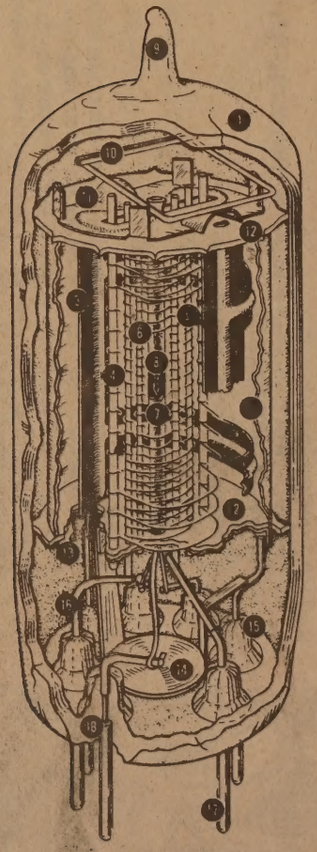

2½ times actual size

1 – Glass Envelope
2 – Internal Shield
3 – Plate
4 – Grid No. 3 (Suppressor)
5 – Grid No. 2 (Screen)
6 – Grid No. 1 (Control Grid)
7 – Cathode
8 – Heater
9 – Exhaust Tip
10 – Getter
11 – Spacer Shield Header
12 – Insulating Spacer
13 – Spacer Shield
14 – Inter-Pin Shield
15 – Glass Button-Stem Seal
16 – Lead Wire
17 – Base Pin
18 – Glass-to-Metal Seal

Structure of a Miniature Tube

3

**5587 *73*
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